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Fire impact and assessment of post-fire actions of a typical Mediterranean forest from SW Spain

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Wildfires may cause significant changes in soil physical and chemical properties. In addition, soil organic matter (SOM) content and chemical properties are usually affected by fire. Fire impacts may negatively affect soil health and quality, and induce or enhance runoff generation and, thereby, soil erosion risk and cause damages to the habitat of species. This fact is especially dramatic in Mediterranean ecosystems, where forest fires are a frequent phenomenon and restoration strategies are a key issue.
The goals of this study are to determine: i) the immediate effects of fire on soil properties, including changes occurred in the quantity and quality of SOM and ii) the effect of post-fire actions on soil properties.
In August 2012, a wildfire affected a forest area of approx. 90 ha in Montellano (Seville, SW Spain; longitude 37.00 º, latitude -5.56 º). This area is dominated by pines (Pinus pinaster and Pinus halepensis), and eucalypts (Eucaliptus globulus) with a Mediterranean climate. Dominant soil types are Rendzic Leptosols and Calcaric Haplic Regosols. It is a poorly limestone-developed soil (usually swallower than 25 cm). Four soil subsamples were collected 1 month and 25 months after fire within an area of approximately 200 m2. Subsamples were mixed together, homogenized, air-dried, crushed and sieved (2 mm). One control sample was collected in an adjacent area. The litter layer was removed by hand and studied separately. Branches, stems, bushes and plant residues on the fire-affected area were removed 16 months after the fire using heavy machinery as part of the post-fire management.
The present research focuses on the study of the elemental composition (C, H and N) and physical properties (pH, water holding capacity, electrical conductivity) of bulk soil samples, and on the spectroscopic analysis (FT-IR, 13C NMR) and analytical pyrolysis data obtained from bulk the oils and from the humic acid fraction.
immediate effects of fire, including the charring of vegetation and litter, as the input of charred residues may contribute to increase the total amount of soil organic matter.
The post-fire removal of vegetation probably contributed to an additional loss of soil material due to an increase of the erosion risk. In addition, preliminary results point out that the burnt soil is not being recovered to the pre-fire conditions at a molecular level neither in the elemental composition.
Results of this study will constitute a valuable tool for stake holders and decision makers to avoid additional alterations caused by post fire management of fire affected forests.